LIGHTWEIGHT REINFORCED TRACTOR-TRAILER SLIDER

BACKGROUND OF THE INVENTION

[0001] This invention relates to a tractor-trailer slider, and more particularly, the invention relates to a lightweight frame structure that increases the strength of the slider while reducing its weight.

[0002] Sliders are used in the trailer industry for repositioning a trailer suspension relative to a trailer frame to redistribute the load on the axles. To adjust the slider relative to the trailer, a pin locking system is actuated to move pins to an unlocked position. In a locked position, the pins selectively couple the slider to the trailer frame at a desired slider position. With the pins in the unlocked position, the trailer and the tractor are driven to reposition the trailer forward or rearward relative to the slider. The pins are subsequently moved to the locked position once the slider is positioned in the desired slider position.

[0003] Occasionally, the pins of the pin locking system do not fully engage the trailer frame. As a result, the slider may become decoupled from the trailer and move from the desired slider position during operation of the tractor-trailer. If no pins are engaged, and the trailer stops during operation, the slider may collide with the trailer causing damage to the trailer and/or slider. If only the pins on one side of the slider are engaged with the trailer frame, the slider may rack, or parallelogram, if the trailer is braked hard.

[0004] There is a need for a slider with improved structural rigidity, and in particular, a structure that better withstands racking, while avoiding an increase in the weight of the slider.

SUMMARY OF THE INVENTION AND ADVANTAGES

[0005] The inventive tractor-trailer slider includes spaced apart longitudinal side rails having control arm supports extending downwardly from the side rails for supporting a suspension. In one example of the invention, each of the control arms supports are provided by spaced apart inner and outer walls. In another aspect of the invention, a unitary plate forms a portion of the longitudinal side rails, for example, a longitudinal upper wall and side walls in addition to one of the inner and outer walls of the control arm supports. The inner and outer walls include a triangular lightening hole that has been flanged to reinforce the walls. The inner and outer walls may additionally include coining and/or ribbing for additional reinforcement. The additional reinforcement may be formed in proximity to upper and lower attachment points, which support upper and lower control arms connected to axles.

[0006] The inventive slider also includes lateral cross-members extending between side rails. The lateral cross-members have an inverted U-shape in one example. The lateral cross-members have tabs on opposing ends that are received in an interlocking relationship with complimentary elongated slots in the longitudinal side rails. This interlocking relationship not only improves the structural rigidity of the slider, but also simplifies manufacturing of the slider by better locating the lateral cross-members relative to the longitudinal side rails during assembly and welding.

[0007] Air spring supports are arranged at forward and rearward portions of the slider and secured to the longitudinal side rails, the control arm supports, and the lateral cross-members to provide a structurally rigid frame. The air spring supports are generally L-shaped unitary plates that extend from a lower portion of the control arm

supports to the lateral cross-members, and generally enclose an opening of the lateral cross-members formed by the inverted U-shape. A portion of a pin locking system, such as the pin linkages, is arranged within a space between the lateral cross-members and the air spring supports to provide protection and support for the pin locking system. The air spring supports provide spaced apart air spring mounting pads that support air springs arranged between the axles and the slider frame. Additional brackets and reinforcements are secured to the slider to provide additional structural rigidity.

[0008] Accordingly, the invention provides a lightweight slider having improved structural rigidity with an increased resistance to racking.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Other advantages of the present invention can be understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

[0010] Figure 1 is a top perspective view of the inventive slider with the suspension components removed for clarity.

[0011] Figure 2 is an exploded top perspective view of the inventive slider shown in Figures 1.

[0012] Figure 3 is a side elevation view of the inventive slider shown in Figure 1.

[0013] Figure 4 is an end elevation view of the inventive slider shown in Figure 1.

[0014] Figure 5 is a top elevation view of the inventive slider shown in Figure 1.

[0015] Figure 6 is partial bottom perspective view of a control arm support of the inventive slider shown in Figure 1.

[0016] Figure 7 is a cross-sectional top perspective view of the control arm support of the inventive slider taken along line 7-7 in Figure 3.

[0017] Figure 8 is a top perspective view of the inventive slider shown in Figure 1 having suspension components connected to the slider.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0018] A slider 10 according to the present invention is shown in Figures 1-8. Figures 1-7 illustrate the slider 10 with the suspension components removed for clarity. The slider 10 frame structure is preferably constructed from plate steel having mechanical properties specified by ASTM A715 with preferably a minimum yield strength of 76 KSI. However, one of ordinary skill in the art would understand that other types of steels may be used and that the steel thickness may vary throughout the frame structure depending upon the loads exerted, the locations of loads, and the overall stiffness desired for the slider 10. Furthermore, the plates of steel are preferably secured together by welding at intersections between the plates on at least one side of the intersection. Most of the weld beads are not shown for clarity.

[0019] Referring to Figures 1-5, the slider 10 includes spaced apart longitudinal side rails 12. The internal structure can be understood from exploded view Figure 2. The longitudinal side rails 12 include an upper longitudinal wall 14 having an

anti-friction member 16 secured to the upper longitudinal wall 14 for reducing the friction between the slider 10 and the trailer (not shown) supported on the slider 10. The longitudinal side rails 12 have longitudinal side walls 18 spaced from one another and depending downwardly from the upper longitudinal wall 14. Control arm supports 20 extend downwardly from the longitudinal side rails 12 and are used to support suspension components such as control arms, which will be discussed relative to Figure 8 below.

[0020] Control arm supports 20 each include spaced apart inner 22 and outer 24 walls. To improve the structural rigidity of the longitudinal side rails 12 and the control arm supports 20, portions of the longitudinal side rails 12 and control arm supports 20 may be integrated with one another so as to use one or more common unitary plates. For example, a first unitary plate provides the upper longitudinal wall 14, a longitudinal side wall 18, and the outer wall 24. A second unitary plate provides the other longitudinal side wall 18 and the inner wall 22 and is secured to the first plate by a weld bead. In this manner, many of the separate prior art members that must be welded to one another are eliminated, reducing the number of welds and consequent areas of reduced rigidity. Of course, it should be understood that the longitudinal side rails 12 may also provide both the inner 22 and outer 24 walls using a single unitary plate bent to provide the longitudinal side rail 12 and control arm support 20 structures shown in the Figures. Rearward positions of the longitudinal side rails 12 have rear reinforcing brackets 59 secured thereto for stiffening, if desired, or they may be omitted to provide a crumple zone.

[0021] The control arm supports 20 are further stiffened by flanging a lightening hole 26. More specifically, a flange 28 at the hole edge is deformed to be

transverse, for example at a right angle, to an adjacent surface 30 surrounding the lightening hole 26. Similarly, portions of the control arm supports 20 are coined. More specifically, portions of the control arm supports 20 are deformed to provide a coined surface 32 as deformed outwardly from the surrounding adjacent surface 30. As best shown in Figure 2, the coined surfaces 32 can be used in proximity to upper 34 and lower 36 attachment points, to which control arms are secured, for additional reinforcement of those regions.

[0022] The areas of the attachment points 34 and 36 are further reinforced by utilizing upper 38 and lower 40 reinforcing brackets. The upper reinforcing bracket 38 is arranged adjacent to the inner wall 22 and bridges the upper attachment points 34, which is best shown in Figures 2 and 6, acting as a control arm support stiffening bracket resisting racking. Upper bushings 42, shown in Figure 7, are arranged between the inner 22 and outer 24 walls to maintain the spacing inbetween the walls 22 and 24. Fasteners are received in the upper attachment points 34 through the upper bushings 42 and the upper reinforcing bracket 38, which is welded in place, to secure the upper control arms to the control arm supports 20. Similarly, lower bushings 44 are arranged between the inner 22 and outer 24 walls, and fasteners are received by the lower attachment points 36 through the lower bushings 44 and the lower reinforcing bracket 40, which is welded in place, to secure the lower control arms to the control arm supports 20.

[0023] Generally L-shaped air spring supports 46 are secured to the slider 10 at forward and rearward portions. The air spring supports 46 provide spaced apart air spring mounting pads 48 having apertures 50 used to secure air springs to the air spring mounting pads 48. The air spring supports 46 include a generally horizontal wall 52

extending to a downwardly depending wall 54, with a curved wall 56 adjoining the horizontal wall 52 and downwardly depending wall 54. The air spring supports 46 extend laterally between the control arm supports 20 on either side of the slider 10.

[0024] Lateral cross-members 74 extend between the longitudinal side rails 12. The air spring supports 46 are secured to the longitudinal side rails 12, the lateral cross-member 74, and the control arm supports 20. The longitudinal side rails 12 and control arm supports 20 form curved edges 58 to which the curved wall 56 of the air spring supports 46 are secured. The inner 22 and outer 24 walls provide edges 60 to which the downwardly depending wall 54 is secured. The downwardly depending wall 54 may include openings 62. Control arms are received in the opening 62 so that the control arms can be secured to the upper attachment points 34.

[0025] The inner walls 22 include a flange 63 extending inwardly that is secured to the air spring supports 46 to provide additional rigidity to the lower portion of the control arm supports 20. The upper reinforcing bracket 38 is secured to the forward and rearward air spring supports 46.

[0026] The air spring supports 46 include a lower edge 64 having a flange 66 arranged transverse, for example at a right angle, to a surrounding adjacent surface 68. As shown in Figure 3, one of the air spring supports 46 includes an elongated slot for receiving a ride height control valve bracket 72.

[0027] The lateral cross-members 74 each include an upper wall 76 and spaced apart lateral walls 78 providing an inverted U-shaped structure. The inverted U-shape structure of the lateral cross-members 74 provide an opening 80 which is generally enclosed by the horizontal walls 52 of the air spring supports 46. Air spring supports 46

include openings 84. Shock brackets 82 are secured to a lower surface of the upper wall 76. The opening 84 enables a shock absorber to extend through the opening 84 for securing the shock absorber to the shock brackets 82.

[0028] The lateral cross-members 74 have opposing ends 86. Each of the opposing ends include protrusions or short tabs 88 and long tabs 90 received in interlocking relationship with a complimentary feature, a notch, in the longitudinal side rails 12. Specifically, an inside longitudinal side wall 18 includes first 92 and second 94 elongated slots. An outside longitudinal side wall 18 includes a third elongated slot 96. The short tab 88 extends through the first elongated slot. The long tab 90 extends through the second 94 and third 96 elongated slots. A weld bead 98 is arranged on the outer longitudinal side wall 18 in the area of the third elongated slot 96, shown in Figures 1, 3 and 8, to secure the lateral cross-member 74 to the longitudinal side rails 12 at the long tab 90 where it extends through the outer longitudinal side wall 18. The interlocking relationship provides additional structural rigidity and resistance to racking. Furthermore, the interlocking relationship simplifies manufacturing by enabling the longitudinal side rails 12 and lateral cross-members 74 to be located during assembly and subsequent welding.

[0029] The slider 10 includes a pin locking system 100. Pin cages 102 are secured to the inside longitudinal side wall 18 for supporting pins 104. Linkages 106 couple opposing pins 104. An actuator rod 108 couples forward and rearward linkages 106 to one another. Holes 110 in the lateral cross-members 74 support the actuator rod 108 for rotation. A handle 112 is connected to the actuator rod 108 for manual rotational manipulation of the actuator rod 108 to move the pins 104 from an engaged or locked

position to an unlocked position, as is well known in the art. An actuator rod support 114 having a hole 116 may provide additional support for the actuator rod 108. This is valuable when the pin locking system 100 includes an arrangement in which the handle 112 is located in a forward portion of the slider 10, as opposed to a location between the lateral cross-members 74. The actuator rod support 114 provides additional protection to the pin locking system 100 in the event of a collision between the slider 10 and trailer supported on the slider 10.

[0030] Referring to Figure 8, suspension components are shown supported on the inventive slider 10. Axles 120 are secured to the slider 10 frame structure by upper 122 and lower 124 control arms that are secured respectively to the upper 34 and lower 36 attachment points, shown in Figure 3. Air springs 126 are arranged between the axles 120 and the air spring mounting pads 48 provided by the air spring supports 46. Shock absorbers 128 are arranged between the axles 120 and the shock brackets 82. An air tank 130 is supported at a rearward portion of the slider 10 by air tank support brackets 132 secured to the longitudinal side rails 12.

[0031] The invention has been described in an illustrative manner, and it is to be understood that the terminology that has been used is intended to be in the nature of words of description rather than of limitation. Obviously, many modifications and variations of the present invention are possible in light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.